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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/944,508      | 08/30/2001  | Warren M. Farnworth  | 3393.6US (97-324.6) | 4342             |

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EXAMINER

FULLER, ERIC B

| ART UNIT | PAPER NUMBER |
|----------|--------------|
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1762

DATE MAILED: 12/04/2002

9

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/944,508

Applicant(s)

FARNWORTH, WARREN M.

Examiner

Eric B Fuller

Art Unit

1762

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 September 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-9 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-9 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) g.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

## **DETAILED ACTION**

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 2 is rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The limitation of controlling the temperature of the ejected solder is not taught by the specification.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-3 and 6-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watts, Jr. et al. (US 6,276,589 B1).

Watts teaches a process where a continuous stream of charged solder droplets is produced (column 3, lines 40-45). Heaters are used to melt the solder in the reserve

Art Unit: 1762

and maintain it in the liquid state while being ejected (column 3, lines 55-65). A piezoelectric crystal vibrator is used to induce a standing pressure wave on the solder, thus producing droplets (column 3, lines 50-55). When ejected, a charge is selectively applied to the solder droplets (column 4, lines 10-12). A bias is used to deflect some of the droplets in a certain dimension and onto a substrate (column 4, lines 15-30). Additionally, some of the droplets are prevented from reaching the substrate as they are passed undeflected into a gutter. The deflection is programmably controlled (column 4, lines 13-34).

As to claim 1, the reference fails to teach that the deflection occurs in a first and second dimension. However, it is taught in figure 1 that deflection plates (16,18), situated to be perpendicular to the Y-axis, are used to deflect the solder in the Y direction while the substrate is moved in the x direction. One of ordinary skill in the art would recognize, from the teachings of Watt, that the addition of two more deflections plates, that are perpendicular to the X-axis, would allow one to deflect the solder droplets in the X direction as well. It would have been obvious at the time the invention was made to a person having ordinary skill in the art to deflect the solder of Watts in two dimensions as opposed to only one. By doing so, the need for substrate movement is eliminated and the droplet placement is more easily and accurately controlled.

As to claim 2, it is the position of the examiner that the heaters that heat the solder in the supply chamber act to control the heat of the solder when it is ejected. This is because the solder is ejected at whatever temperature the supply chamber stores the solder.

As to claim 6, since both the present invention and the reference teach using the apparatus for ejecting solder droplets onto a printed circuit board, and the method of producing the droplets that is taught by the reference is the same as that of the applicant's claim, it is the position of the examiner that the diameter of the solder droplets of the reference would be inclusive of the range that is claimed by the applicant.

As to claim 7, it is taught that the desired pattern is what determines if the droplets are caught by the gutter (blanked) or allowed to reach the substrate (column 7, lines 40-50). Figure 1 shows horizontal lines being produced, wherein the absence of solder between the endpoint of the previous horizontal line and the starting point of the next horizontal line shows that it is not desirable to have solder between these two points. Therefore, it would have been obvious to one skilled in the art to blank the solder stream when the stream is positioned between these two points.

As to claim 8, examiner admits that Watts teaches that it is the undeflected droplets that are blanked. However, it is the examiner's position that to allow the droplets to fall undeflected into a gutter that is positioned directly under the stream or to deflect the stream into a gutter that is positioned slightly away from directly under the stream are functionally equivalent to each other, as both act to prevent solder from reaching the substrate. To use either method would have been obvious at the time the invention was made to a person having ordinary skill in the art with a reasonable expectation of success.

Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watts, Jr. et al. (US 6,276,589 B1), as applied to claim 3 above, and further in view of Nakasu et al. (US 6,213,356 B1).

Watts teaches the limitations of claim 3, as shown above, but fails to teach that separate piezoelectric crystals generate the pressure inducing step and the vibration step. Watts does teach to use a piezoelectric crystal for the vibration step (column 3, lines 50-55). Nakasu teaches to use of a piezoelectric crystal when pressurizing a supply of solder in order to increase consistency of the droplets being ejected (column 2, lines 36-61). Therefore, to have a second piezoelectric crystal control the pressure of the supply chamber in Watts would have been obvious at the time the invention was made to a person having ordinary skill in the art. By doing so, the consistency of the drop formation is increased. The diameter of the drop is read upon by Watts as shown above with respect to claim 6.

### ***Response to Arguments***

Applicant argues that it would not have been obvious at the time the invention was made to have the additional deflection plates added to the apparatus of Watts, such that deflection may occur in two dimensions. Applicant further argues that by eliminating the need for substrate movement, which is one of the examiner's sources of motivation for the modification, the location of the substrate immediately underneath the gutter would be blocked from deposition, thus limiting the apparatus of Watts. This argument is not found persuasive.

First, it is recognized that Watts clearly provides a teaching that the pair of deflection plates, arranged perpendicularly to the Y-axis, provides deflection in the Y-axis. To provide two more plates to cause deflection in the X direction is merely a duplication of parts. The benefits of having control in two directions would instantly be obvious to one of ordinary skill in the art, as control in two directions would allow for more control of the deposition process and eliminate the need for substrate movement in the X direction.

As to the applicant's argument of the elimination of substrate movement causing it to be impossible to deposit solder below the gutter, it is pointed out that Watts does not teach that it is desirable to, nor teaches a method of, supplying solder in the area below the substrate. Therefore, the modification still allows for success of the process taught by Watts. From the disclosure of Watts, no steps are taught that allows for deposition in the area of the substrate that is located below the gutter, since deflection only exists in the Y direction. As the substrate in Watts is moved in the X direction, the area below the gutter is refreshed with a new area of substrate that is also incapable of receiving a solder bump. Therefore, Watts teaches a process wherein an entire line of the substrate is incapable of receiving solder. To use the modification of deflecting in the X direction as well, as suggested by the examiner, it is possible to deposit solder in areas above and below the gutter (in the X-direction). Therefore, to have deflection in two directions further has the advantage of allowing for deposition in a greater area on the substrate than would be possible with deflection in one direction coupled with substrate movement in the other.

The applicant argues that the heaters in the supply chamber only act to melt the solder and do not control the temperature of the solder as it leaves the ejector. This is not found persuasive. Watts teaches that the solder is heated to a desired temperature in the supply chamber (column 5, lines 20-25). The solder from this chamber is then ejected. Therefore, the heaters used to heat the solder to the desired temperature read on controlling the temperature of the ejected solder.

Applicant argues the rejections based on claims 4 and 5, as they have been amended. These arguments are moot in view of the new grounds of rejection.

Applicant argues that the diameter of the droplets is not explicitly taught by the reference. However, it is the position of the examiner that since the droplets are used for the same purpose, and the formation method taught by the reference is the same as that claimed, the diameter of the droplets taught by Watts would be inclusive of the broad range claimed by the applicant.

Applicant argues the combination of Watts with Smith with respect to claim 8. Examiner has withdrawn this rejection. It is noted that claim 8 is still rejected by Watts alone.

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).



Art Unit: 1762

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eric B Fuller whose telephone number is (703) 308-6544. The examiner can normally be reached on Mondays through Thursdays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive Beck, can be reached at (703) 308-2333. The fax phone numbers for the organization where this application or proceeding is assigned are 703 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.



EBF

December 1, 2002



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